ISEE 2019 SYMPOSIUM ABSTRACTS

ISEE 2019 hosts 21 symposia which were selected from a list of more than 60 competitive proposals. The titles, conveners and symposium abstracts are shown in this document. The Final Program will provide more information on location, date and time, and speakers of the symposia.

S01

Mapping the Air Pollution Metabolome: Applications, Limitations, and the Path Forward

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High-resolution metabolomics (HRM), involving the quantitation and identification of thousands of exogenous and endogenous metabolic features, has emerged as a promising tool for biomarker discovery and etiological inquiry into environmentally-mediated disease. Previous HRM-based studies have focused on questions related to the analytical sensitivity of high-resolution platforms in generating high quality data, optimal biological matrices for use in research applications, and limited investigations examining associations between specific environmental stressors and corresponding metabolite expression. Recently, several groups have demonstrated the capability of HRM to reflect internal metabolic signals associated with urban air pollution in panel-based and cohort study settings. These results, while promising, raise questions related to concordance and coherence of findings among studies, the necessity of developing standard protocol in collecting and processing HRM data, and specific applications and limits of HRM as a means of informing air pollution epidemiology. This symposium, sponsored by the HERCULES Exposome Research Center, a cross-institution initiative designed to promote infrastructure and expertise in exposome research, will include presentations and discussion from groups actively engaged in HRM-based air pollution health effects research. The session will conclude with comments from a select panel to explore the potential of HRM for generating new hypotheses through pathway discovery and in the development of new, biologically-relevant exposure metrics for air pollution health studies.

S2

Harmonizing insights from intervention studies, contextual information and resource availability to develop policy advocacy for clean cooking and domestic fuel adoption in Africa

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More than 3 billion people worldwide rely on polluting energy sources such as wood, dung and charcoal for cooking. Over a billion people still lack access to electricity and must rely on polluting candles and kerosene lamps to light their homes. Household air pollution produced by polluting fuels and technologies is a cause of some 4 million deaths from noncommunicable diseases (including heart disease, stroke and cancer), as well as pneumonia. Inefficient household energy use is a health and livelihood risk for women, children and infants (WHO, 2018). Access to clean energy will save lives, stimulate socio-economic development and poverty eradication. The 2016 World Energy Outlook report showed that if policies on energy access for poor countries do not change radically, particularly in Africa, there will be little or no further reduction in the numbers of people relying on polluting solid fuels and kerosene.

The session objectives are to provide insights from cooking fuel intervention studies in sub-Saharan Africa to provide health benefits, evaluate contextual information on current efforts on provision of clean fuel, outline steps to initiate advocacy for faster adoption of clean fuel technologies in Africa and provide evidence-based recommendations to regional policymakers.

The symposium is being organized by members of ISEE Africa chapter. The session will be rounded up with an interactive session on how solid fuels were replaced with natural gas and renewable energy in developed regions. The near-term goal is to work with the ISEE Policy committee to develop and issue policy statement to regional policymakers (through the African Union etc.) to support domestic use of natural gas resources and promote the use of cleaner cooking and lighting fuel. This will boost the goal of the ISEE Africa chapter to translate research findings into timely and effective policy frameworks in the continent.

This symposium is about discussing the future of a major environmental health issue in Africa. It is in line with the meeting theme - ‘On Airs, Waters, Places’ and goal to discuss the future of Environmental Epidemiology in the world.

The symposium will support research collaboration among different groups working on domestic energy and cooking fuels in Africa. It will promote formulation of consistent message and evidence-based recommendations to regional policy makers in Africa. It will also provide opportunity for ISEE to contribute to advocacy on improving air quality in Africa and contribute to a healthy, safe and prosperous Africa.

S3

One Health: On animals, humans and the environment

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The One Health concept is a multidisciplinary and collaborative approach to address potential or existing health risks that originate at the animal-human-environment interface. One Health approaches recognize the interconnectedness of human health with animal health and the environment and address challenges from zoonotic infections and antimicrobial resistance to chemical exposures and occupational risks to animal workers. The One Health concept has also been applied to studies of the human, animal, and environmental microbiome, addressing the health implications of non-pathogenic microbial exposures.

Given the global trends towards intensification and expansion of livestock farms, increasing demands for animal-based food products, urbanization, biodiversity loss and other ecological impacts of climate change, the One Health approach will continue to be an important tool in environmental epidemiology.

This symposium will provide an overview of the One Health approach, how it can be applied to the environmental epidemiology field, and state-of-the-art presentations that highlight the variation of emerging exposures and related health risks. In line with the meeting theme, the symposium will address the One Health concept in relation to air pollution, water-related risks, and 'places' with special interest, e.g. the farm environment and the indoor environment.

This symposium will address history and future perspectives of One Health in the context of environmental epidemiology. Presenters will address the various sources of relevant environmental exposures, and current developments in methodology. The proposed presentation titles are directly connected with the conference theme.

S4

Expanding the Role of the Environment in the Global Burden of Disease

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The Global Burden of Disease (GBD) has estimated the contribution of several environmental exposures, including particulate matter and ozone, radon, drinking water and sanitation, lead, and a number of occupational exposures, to the burden of disease from health outcomes for which causal criteria are met. The process for including exposure-outcome pairs in GBD estimates is not well known to most environmental epidemiologists, however. Further, most epidemiologists are not aware of how they could present their findings to facilitate inclusion in GBD calculations and thus increase their public health impact. Additionally, the possibility of including additional environmental exposures in future GBD estimates is of considerable interest to the environmental epidemiology research community, including funding agencies. This symposium will include perspectives from individuals responsible for the ongoing work of the GBD, those who have participated in previous GBD analysis of environmental epidemiology data, and consumers of GBD analyses. We will also discuss the new Global Burden of Disease-Pollution and Health Initiative (GBD-PHI), recently begun with the aim of improving GBD estimates and also accelerating the inclusion of additional exposures into the GBD.

The ISEE2019 meeting theme is On Airs, Waters, Places. The proposed symposium aims to increase the public health impact of environmental epidemiology studies addressing these general areas. The symposium is designed to increase understanding of the Global Burden of Disease by environmental epidemiologists. It will address how this program works, how exposure outcome-pairs are chosen, assessing air pollution and climate change in the GBD, and how the inclusion of environmental exposures in this important public health project might be increased. Attendees will learn how their research reporting can be made more amenable to inclusion in this important activity.

S5

PFAS Research Reaches its Adolescence: What Have We Learned and Where Are We Going?

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In the past decade, concerns with potential health effects of perfluoroalkyl substances (PFAS) have grown from a minor issue to a prominent health concern for researchers, public health policy makers, and the general public. Following an episode of contamination in the mid-Ohio Valley in the US, the C8 Science Panel members conducted an array of studies that helped to advance both methods and substantive knowledge of potential health effects. Many studies have followed of varying character and quality, making it timely to take stock of the evolving methods to identify the critical concerns and promising avenues for making meaningful progress. By examining the evolution in thinking about this issue from the early phases to the present, we will take stock of progress and pinpoint gaps in the literature that need more focused attention. The most informative opportunities among candidate exposed populations, ranging from communities with typical levels to contaminated sites to occupational groups, bring varying methodologic strengths and limitations. Progress has been made to better define the challenges in assessing exposure, addressing the spectrum of health outcomes of concern, the daunting challenge of addressing the growing spectrum of specific chemicals of concern, how to better combine evidence from toxicology and epidemiology, and recognizing the role that different exposure pathways may contribute, not limited to drinking water. Major new studies are in progress and an assessment of their promise for answering some questions but not others will help to focus attention on additional work to undertake even before these are completed. Finally, even with the present incomplete level of understanding, policy decisions must be and are being implemented, with a need to make optimal use of the available evidence while recognizing its limitations.

This assessment fits well within the meeting title (relating directly to “Water”) as well as the subheading, “History and Future of Environmental Epidemiology.” While research on PFAS proliferates, there is value in a closer look at the evolution of this work in the past decade, promising (and less promising) directions, and key methodologic issues that need to be considered to accelerate progress towards advancing the science and improving our ability to guide policy.

S6

Lead's long-term legacy: what past exposures can tell us about future disease

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Though harmful lead exposure is still a fact of life in many communities in both developed and developing countries, public health interventions to remove lead from paint, pipes, and gasoline have succeeded in dramatically lowering the global burden of lead on the world's population. Yet, new evidence from long-term observational studies of lead-exposed individuals suggests that, though lead exposures are down, the health consequences of past exposures still linger. Evidence now also suggests that new consequences of historic exposures may emerge in the coming years, as the generation of children with the highest lead burden (those born in the 1950s, 1960s and 1970s) enter old age.

This year marks the 50th anniversary of the peak of the lead pandemic and the 40th anniversary of Herbert Needleman's landmark New England Journal of Medicine investigation that reported neuropsychological deficits in children exposed to low levels of lead. In the years since we have learned that no level of lead exposure is safe, for children or adults. As the 31st annual conference of the ISEE seeks to consider the history and future of environmental epidemiology, this symposium would look both backwards and forwards to ask what the lead exposures of the past might foretell for public health and disease in the future.

Humans have been releasing harmful levels of lead into the environment for millennia (long before Hippocrates ever sat to write "On Airs, Waters, Places"). While the short-term consequences of lead exposure are, by now, well known, the long-term consequences remain poorly characterized. This symposium will bring an important historical perspective to the conference and, at the same time, raise awareness of an issue with large implications for public health in the future.

S7

Of moderators and mediators: Complex relationships between greenness, air pollution, noise, and health behaviors in driving health outcomes

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An increasing body of literature demonstrates that living in greener areas is associated with numerous benefits to health, including lower rates of obesity, mortality, and cardiovascular disease, reduced stress and improved mental health, and more favorable birth outcomes. There are many hypotheses regarding how these benefits are achieved, ranging from reduced exposures to noise, air pollution, traffic congestion and other stresses of urban life, increased opportunities for physical activity and social interactions, and increased opportunities for stress recovery.

The vast majority of published studies, however, consider only the relationship between a single exposure (e.g., air pollution, noise, or greenness) and the selected outcome of interest. Very few studies examine several of these factors simultaneously or seek to understand how they interact with each other to influence health or health behaviors, such that the mechanisms and pathways through which greenness is operating on health remain poorly understood.

The purpose of this symposium is to present findings from several large cohort studies demonstrating evidence of greenness acting as a moderator (i.e., influencing the strength or direction of the relationship) between an exposure variable and a health outcome, and health behaviors acting as mediators (i.e., explaining the relationship) between greenness and a health outcome. For example, we present results from the Canadian Census Health and Environment Cohort (n= 2.4 million individuals) showing that the association between exposure to PM2.5 and risk of mortality is greatly attenuated (i.e., moderated) in greener areas. Results from the US-based Nurses' Health Study (n=121,000) show that physical activity mediates the association between greenness and cognitive decline. Together, the findings from all of these studies extend our understanding of how living in greener areas may lead to improved health outcomes and behaviors.

The topic of this symposium exemplifies several key aspects of next-generation environmental epidemiology. Due in part to increasing access to and availability of novel environmental datasets, there is a clear move in this field towards studies that consider multi-factor impacts and exposures on health. An important future direction for studies on greenness, in particular, involves moving beyond identifying broad associations between "greenness" and health, towards trying to describe and understand the mechanisms through which greenness affects health and health behaviors. Lastly, all of the case studies described are centered on effects of place on health.

S8

Setting the European Environment and Health Research Agenda, 2020-2030: the HERA project

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Background. Environmental degradation and pollution, climate change, and deterioration of biodiversity of ecosystems damage health and quality of life, affecting especially socially disadvantaged and vulnerable populations. Action is urgently needed to drastically reduce exposures that are destructive to the environment and human health and promote healthy environments and sustainable development. The HERA coordination action, funded by the EU Horizon2020 research framework program, will set priorities for an environment and health research agenda in the EU for 2020-2030, closely connected to policy needs.

Significance. This large initiative involves researchers and a wide spectrum of stakeholders and ample consultations and will set priorities for environmental health research to underpin policies for 2020-2030 for Europe. This will be the first time that such a wide-scale initiative on setting environment and health research agenda takes place in Europe. At the symposium we will present the approach, delineate the main themes and discuss the challenges for defining priorities in environmental health research and policy in Europe.

Content: The symposium will be based on short presentations on key aspects of the project, will include online voting tools such as Mentimeter to promote debate, and a final discussion led by a key stakeholder representing European cities. We will discuss challenges in: (i) identifying key areas in the field of environment and health that will benefit from new scientific evidence in the next decade including research on specific exposures (e.g. endocrine disruptors), sectors (e.g. transportation) and global issues particularly climate change; (ii) developing strategies and tools to ensure the engagement of stakeholders, increasing coordination and cross-fertilisation of ideas, and contributing to the European environment and health process and policy activities; (iii) evaluating methods and providing estimates of the burden of disease; and (iv) developing a European medium-term research and innovation agenda covering key strategic research and policy aspects.

The symposium relates directly to the meeting themes discussing specific exposures (e.g. air-pollution, water contaminants), wider settings (e.g. cities, waste) and incorporating a global perspective (e.g. climate change). Community participation is key in defining priorities and this is also a central theme of the conference. We are particularly interested in promoting participation of ISEE researchers from Europe and internationally in this major initiative. We expect that the project will also help cover an existing gap in ISEE, namely, that, until now, ISEE has not developed a systematic approach on priorities in environmental health research for policies.

S9

Assessing health co-benefits of climate change mitigation in the Asia-Pacific region

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Aim of the symposium

To address some important challenges in the co-benefit analysis of climate change mitigation and the progress in tackling these challenges in the Asia-Pacific region.

Background, significance, and content

Climate change is the greatest health challenge of the 21st century. Global warming impacts on population health through direct, indirect and diffusing pathways. It becomes increasingly clear that the warmer the globe, the greater the health risks. Burning fossil fuels for energy, transport, land use and industry is the main source of the carbon emissions that are driving climate change, and also a major contributor to air pollution, which kills over seven million people every year. One third of global air pollution deaths occur in Asia Pacific. Reducing carbon emissions can also help curb air pollution, which could lead to substantial health co-benefits.

In this proposed symposium, we will present studies on the health co-benefits of climate change mitigation in the Asia-Pacific region and strategies to take action. Discussion priorities will include the similarities and heterogeneity of the research findings across the region, methodological challenges, research needs, climate action and potential collaborations.

The proposed symposium is directly related to the ISEE19 meeting theme “On Airs, Waters, Places”, as climate change will increasingly affect the quality of air and water as well as where we live. It is anticipated that this symposium will encourage people to take action to mitigate climate change across the globe, particularly in the Asia-Pacific region.

S10

Quasi-Experimental Designs in Environmental Epidemiology: Applications to the Health Impacts of Energy Policy Changes

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Energy policies dictate how energy is produced, distributed, and consumed but the legislation itself does not necessarily fully investigate its potential population health impacts. These health impacts are often difficult to quantify in traditional epidemiological studies due to spatiotemporal confounding. However, as these policy changes are made, their health impacts can be accessed via econometric-based quasi-experimental designs. Two of the speakers in this symposium are economists doing environmental health research while the other two are environmental epidemiologists using econometric quasi-experimental designs in their own work. All of these talks will highlight the benefits of implementing quasi-experimental designs and demonstrate how these designs can lead to better causal inferences. Each talk will assess a different hazard from the energy sector with air, water, or physical emissions that may affect a significant segment of a population and highlight the importance of taking account local place characteristics in these analyses. Key methodological topics that will be covered include defining treatment status, selecting counterfactual populations, and implementing multistage models. Although these talks primarily leverage health data from the United States, these methods and study questions are applicable to settings around the world.

This symposium encompasses the relationship of place to the health impacts of air and water. Our symposium commences with two presentations on air quality, and another one on water quality. The connecting theme throughout these presentations is the impact of who chooses to live in these places and how accounting for these local population dynamics can impact health. Energy policy is a key area of environmental epidemiology where changes to regulations or practices likely impacts groups who are unrepresentative of the general population. This symposium will be of immense interest to audiences from any countries considering changing their energy policies.

S11

Conducting research on environmental epidemiology with Indigenous Peoples

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At least 370 million people from all inhabited continents define themselves as Indigenous Peoples (IPs). Though IPs make up around 5% of the global population, they account for more than 15% of the extreme poor. Moreover, environmental degradation threatens their survival, as IPs typically meet their daily needs directly from the local environment. Moreover, IPs also have deep cultural and spiritual connections with their lands.

IPs increasingly find themselves affected by global environmental change, both through the increase of local threats such as expanding agriculture and extractive industries (mining, logging…), but also through global threats such as climate change. This poses a risk for IPs' health that adds on the already existing differences in health status between Indigenous and non-Indigenous peoples.

However, IPs should not only be seen as victims of environmental degradation, but also as potential agents of change. Research shows that the formal incorporation of IPs, their knowledge systems, and their many locally attuned management systems into environmental management can be an effective way to reduce environmental degradation, and consequently to reduce its health impacts.

In this symposium, we highlight the importance of conducting environmental health research with IPs, as a way both to address environmental injustice and to better incorporate IPs perspectives in addressing global environmental problems. The symposium will start with an introductory talk (25 min) reviewing the current state of knowledge on i) the exposure and vulnerability of IPs to pollution risks, ii) the environmental, health and cultural impacts of pollution upon IPs and their territories, and iii) IPs' contributions to control and abate pollution from local to global scales. Following this, we will present different approaches to conduct research with IPs including participatory research, qualitative methods, and new technologies for exposure assessment in remote settings (3 presentations, 20 min each).

The theme of the symposium leads to discussion on the future of Environmental Epidemiology. In a context of global environmental change, it is of uttermost importance that research on Environmental Epidemiology includes evidence from a wide range of populations, and specially from populations living in close contact with their local environments, as they tend to be more impacted by environmental changes. The global approach also requires the inclusion of different views and perspectives, such as the ones that can be provided by Indigenous knowledge, to come with novel solutions to overcome the daunting environmental challenges ahead.

S12

Estimating the Global Risk and Burden of Particulate Air Pollution Exposure: Issues and Challenges

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Estimates from the Global Burden of Disease (GBD) project place ambient and household air pollution among the leading global risk factors for premature mortality from non-communicable diseases. Ambient and household PM2.5 ranked 5th among global mortality risk factors in 2017, following high blood pressure, smoking, high fasting plasma glucose and high total cholesterol. The Integrated Exposure Response function, or IER, was essential to making these estimates, combining information on the mortality risk from exposure to diverse sources of combustion-derived PM air pollution, including cigarette smoking, to estimate the burden of disease attributable to PM2.5 exposure in ambient and household environments at levels that had not been directly studied epidemiologically. But the IER rests on a range of strong assumptions and is a main source of uncertainty in the GBD estimates and those made by WHO, the World Bank, and a large number of academic researchers who have adopted it.

Since its introduction in GBD 2010 the IER has evolved to keep pace with new scientific evidence and continuing technical challenges. The increasing number of air pollution cohort studies over the last decade, including recent Chinese studies, have provided an opportunity to formulate approaches to estimation of the exposure-response relationship of PM with mortality based in epidemiological data that avoid the underlying assumptions of the IER. Consequently, there is now an ongoing discussion regarding the way forward for air pollution risk estimation for the quantification of disease burden.

This symposium will discuss critical issues concerning methods to estimate the exposure-response relationship for mortality due to long-term exposure to fine particulate matter over the global concentration range for ambient and household exposure, and critically explore options for the future.

The proposed symposium addresses directly the conference theme “On Airs, Waters, Places.” Air pollution is the leading global environmental health risk factor and a leading cause of disease burden, whose magnitude varies over time in places across the world. Over the past 20 years epidemiologists have developed methods which have made it possible to quantify that burden. These methods, and their historical and future evolution, are of critical importance to continuing progress in quantifying and reducing the burden of disease due to air pollution.

S13

How Low Should We Go? New Health Research on Low-level Ambient Air Pollution

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Levels of ambient air pollution have declined significantly over the last decades in North America, Europe, and in other high-income regions. Nonetheless, epidemiologic studies continue to report associations of air pollution with adverse health effects in the general population at these lower levels of exposure. Recently some studies have found associations at levels below current ambient air quality standards and guidelines. In order to inform future regulation, disease burden estimation and risk assessment, it is important to know whether adverse effects continue to be observed as levels of air pollution decline still further, and what the shape of the exposure-response function is at those low levels. These issues are currently major sources of uncertainty in air quality standards decisions.

Large populations are needed for such studies in order to accurately estimate air pollution effects at low exposure levels. There are increasing opportunities to study air pollution effects in very large study populations, via consortia combining existing cohorts, or by using data obtained from, for example, administrative databases, such as the census or health insurance programs. Very large studies have the advantage of increased statistical power and are generally more representative of the general population – two important features lacking in many current (smaller) cohort studies - that are of critical importance for use in burden and risk assessments. However, very large studies need to address other major methodologic challenges. Critical study design considerations include reliable exposure information including an assessment of exposure measurement error, and approaches to control for important confounders in the absence of such data at the individual level.

The symposium will present results of three studies investigating the health effects of low-level exposure in very large populations in the US, Canada, and Europe, address their strengths and weaknesses, and discuss implications for future risk assessment and regulation.

The topic is of scientific interest and directly relevant to risk assessors and policy makers; therefore, we expect it would appeal to a broad audience at ISEE. The emerging scientific evidence for effects at levels below current air quality standards, provides a continuing impetus for lower standards. The topic is timely because of ongoing deliberations of the new PM and O3 U.S. National Ambient Air Quality Standards, Word Health Organization Air Quality Guidelines, and the Fitness Check of the EU Ambient Air Quality Directives, which are expected to be completed late 2019/early 2020.

S14

Use of Exposomic Methods Incorporating Sensors in Environmental Epidemiology

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Exposomics is an emerging area within the environmental health sciences that concerns the measurement and characterization of the totality of exogenous and endogenous factors to which humans are exposed. As the concept of exposomics gathers interest and investment, the demand for technologies and methodologies that accommodate high-dimensional exposures (i.e., “exposomic sensors”) has concomitantly increased.

Among the most promising of these technologies are silicone wristbands that enable measurement of >1500 chemical compounds, microneedle skin patches that non-invasively collect interstitial fluid and provide a practical alternative to venipuncture and serum collection, and passive wristbands that measure an array of airborne contaminants. Each of these technologies provide novel and practical means to measure many of the exogenous and endogenous factors that constitute the exposome.

Although these technologies possess great promise for advancing our ability to measure the exposome, they are recent technological advancements and therefore remain unfamiliar to many environmental health researchers. Further, these technologies have been applied in only a small number of settings to date, and the full extent of their utility in supporting the goal of characterizing the exposome remains unclear. As such, introducing these technologies to a wide audience of environmental health researchers may help accelerate their adoption, refinement, and fruitful application.

Therefore, in this symposium, researchers that have developed or employed these technologies in epidemiologic research will introduce one of the aforementioned exposomic sensors, highlight the sensor’s strengths and weaknesses with regards to epidemiologic research, and discuss possible research applications. We will conclude with an open discussion of the application of these technologies to environmental health research.

Exposomics is an ambitious but natural extension of exposure assessment towards the ultimate goal of measuring the totality of non-genetic factors that affect human health. Although the concept of exposomics was recently established, it is already recognized as a major conceptual advancement in environmental epidemiology. Our symposium relates to the Meeting Theme “On Airs, Waters, Places”, which concerns the past and future of environmental epidemiology, in that interest and investment in technologies and methodologies that support characterization of the exposome will undoubtedly continue to grow and will likely become a major component of environmental epidemiology in the future.

S15

Interaction between environmental chemicals and toxicants and the human microbiome

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Background: Sources of exposure and body burden to various environmental chemicals and toxicants have been reported for different age-groups and populations. It is well-known that many of the persistent as well as non-persistent chemicals might have detrimental impact on our health. The chemicals and environmental compounds – with many showing ubiquitous exposure - may not only affect our immune system and various health outcomes directly but may also influence our health indirectly by modifying the microbiome.

Significance: With the new era of microbiome research made available through advanced high-throughput sequencing methods, we now have the possibility to study how these environmental chemicals affect the bacterial composition in our body. There is also growing evidence that the microbiome may metabolize environmental chemicals. Thus, it is likely that the interaction between chemical exposure and microbiome can influence health outcomes, and this should be taken into consideration in risk assessment.

Content: This symposium will cover some of the most important environmental exposures that are known to impact human health; air pollution, tobacco compounds, antibacterial chemicals, persistent organic compounds and toxicants. This symposium will provide insight into how these compounds affect the composition of the microbiome; mainly human microbiome, but also with contribution from experimental models.

S16

Emerging PFAS in drinking water is a global public health issue

Kotlarz N [1], Hoppin J [1]

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Background: Per- and polyfluorinated alkyl substances (PFAS) are a group of man-made chemicals that are environmentally persistent and highly soluble in water. This group includes the historically used chemicals PFOA and PFOS as well as newer or “emerging” PFAS designed to be less environmentally persistent. PFAS are pervasive contaminants of drinking water. However, little is known about exposure or human health effects of emerging PFAS.

Significance: Thousands of emerging PFAS are being produced or are byproducts of chemical production. Around the globe, communities are becoming aware of emerging PFAS in their drinking water, with little information about biological persistence or human health effects.

Content: The proposed symposium will focus on the diverse populations who have been exposed to emerging PFAS around the world. In North Carolina, PFAS contamination of the Cape Fear River by a PFAS manufacturing plant resulted in ~250,000 people downstream being exposed to GenX and other emerging PFAS through their drinking water. Non-targeted chemical analysis identified emerging PFAS in both tap water and blood samples from this population; no toxicology or human health data are currently available for these PFAS. Similarly, people in Dordrecht, The Netherlands, were exposed to GenX and other PFAS released by a fluorochemical manufacturer. Release of firefighting foam at the Peterson Air Force Base in Colorado is believed to be the source of PFAS contamination of drinking water for ~75,000 people. Municipal drinking water highly contaminated with PFAS by firefighting foam was distributed to ~20,000 inhabitants in Ronneby, Sweden for decades.

S17

Residential exposure to pesticides and health effects; What we know and what we should know

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The application of pesticides in the vicinity of homes has raised much public concern and discussion regarding the possible health effects of people living in close vicinity to agricultural land (residents). Several studies have indicated health effects among both children and adults that live in close proximity to agricultural land. However, these studies often are hampered by the lack of reliable exposure data.

Recently, several large efforts have been initiated to better understand the exposures of residents to pesticides that live close to agricultural fields. These studies have applied a variety of methods varying from biological monitoring, to house dust measurements, exposure algorithms, and geospatial models. But how well do these methods work and what do they tell us about the possible extent of the problem?

In this proposed symposium we will bring together and present the results of recently conducted exposure and health studies to explore what we know and what we should know.

The proposed topic is of great importance as it is generally assumed that if exposure and health effects of workers and bystanders are controlled than residents should be safe as well. But is this really true? And are the models used to assess residential exposures in the regulatory framework adequate? And if so how is it possible that several epidemiological studies have observed health effects?

The proposed format of the symposium is four short talks on recent observations on quantifying the residential exposures of residents using a variety of methods and study designs and their associated health effects. The symposium will be concluded with a panel discussion with the aim to shape a future research agenda on this topic.

Residential exposure to pesticides is an important public health concern given the large amounts of pesticides used on crops worldwide. But what do we know about how they migrate to the air and water resulting in human exposure. To address this problem several studies have recently been initiated to study the extent of the problem. In this symposium we will present these new results and will bring the evidence from different parts of the world together to explore what the current knowledge is and what the next steps should be.

S18

Landmarks of Air Pollution Epidemiology: Legacy of Douglas Dockery

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In 1979 the American Journal of Epidemiology devoted an entire issue to a review of the health effects of particulate air pollution, concluding there was no evidence for negative health effects from particulate pollution at levels seen in Europe and the US. Forty years later, the threat of particulate air pollution or particulate matter (PM) to public health which some denied even existed has been confirmed, addressed by public policy, and significantly reduced, based on the foundations provided by epidemiology. Over that period, Professor Douglas Dockery has partnered with leaders to produce landmark papers which have redefined air pollution epidemiology. Furthermore, he has mentored many of the current leaders in the field who are continuing to provide novel insight into the extent of the health effects of air pollution and the mechanisms behind these associations. In this symposium, individuals who have worked closely with Dr. Dockery will cover five topics summarizing the body of his work: effects of ambient PM exposures on respiratory health of children, effects of acute PM exposures and cardiovascular outcomes; effects of chronic PM exposures and life shortening; exposure assessment in epidemiology; and synthesis of PM studies and effects of control of PM. We will discuss Dr Dockery's contributions, in the context of how his research has laid the foundation for the important questions being asked today. The former mentees of Dr. Dockery will point out their lessons learned as an inspiration for young investigators. We will highlight the evolution of the evidence under the direction of Dr. Dockery's leadership supporting policy implementation, displaying a rich portfolio of epidemiological study designs used to substantiate the evidence. The achievement of building policy implementation based on data science has not lost its relevance and the implications for today's environmental health challenges will be discussed.

The symposium fits the theme of the conference "History and Future of Environmental Epidemiology." Douglas Dockery has been one of the leaders in the field of air pollution epidemiology for more than 40 years. Thus, his accomplishments and body of work represent the history of the field. This research has motivated and laid the groundwork for today's research and many of today's leaders were mentored at some time or another by Dr. Dockery, representing the future of the field. The speakers were chosen because of their direct collaboration with Dr. Dockery's body of work.

S19

Climate Change and Child Health: Current Research, Future Opportunities, and Gaps in Knowledge

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The public health community now recognizes that climate change has far-reaching impacts on population health. Rising temperatures, severe storms, shifting patterns of precipitation, and sea level rise are projected to affect an increasing number of people through the end of the century, with both direct and indirect consequences for health. Children are uniquely vulnerable to the threats posed by climate change due a constellation of both biological and behavioral factors, including differences in physiology, metabolism, activity patterns, and diet relative to adults, as well as their dependence on caregivers. Yet despite the potential for heightened vulnerability among children and the need for adaptation strategies tailored to this population, research on the health impacts of climate change to date has been largely focused on adults. This symposium will highlight current research in the field of climate change and child health and identify opportunities and challenges in continued research and research translation for protecting children as global temperatures continue to rise. More specifically, talks in this session will review the current state of research on climate change and children's health, describe ongoing research projects in this field, and discuss the development and evaluation of adaptation strategies to minimize health impacts of climate change on this population. In addition, time will be reserved for a moderated discussion among presenters and audience members.

The study of the potential health impacts of climate change is a rapidly expanding branch of environmental epidemiology. We propose to use this symposium as a forum to reflect on the current state of climate and health research, with a particular focus on children, as well as to identify barriers to and opportunities for continued research and research translation in this area. As such, our proposed symposium is well-aligned with this year's focus on the future of environmental epidemiology.

S20

A world less dependent on fossil fuels – scientific evidence and corporate influence. An ISEE Policy Committee Symposium

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The reliance on fossil fuels has been considered a major environmental threat for half a century. The evidence emerging in the recent decades, often based on epidemiology, has proven direct health risks of air pollution from fossil fuels combustion and global risks to health and the environment of climate changes due to greenhouse gases emission. Results of epidemiological studies and health impact assessment are being used in the developmental and policy discussions, and often affect financial interests of very powerful industries. The proposed Symposium will illustrate major aspects of health consequences of fossil fuel combustion and the reactions of the industry trying to influence epidemiological research. We will also discuss to challenges in Low-Medium Income countries regarding energy policies and prospects for major global alliances to apply climate agreements. The discussion will focus on the way epidemiologists should continue providing essential support to health policies avoiding corporate interests while encouraging industry and other stakeholder involvement as a part of the solution to the problem.

S21

When the Answer is “Big(ger) Data in Environmental Epidemiology: What are the Questions?

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Definitive answers to several types of Environmental Epidemiology research questions appear to require the use of ever larger data sets. In addition to meta-analytic approaches, researchers are increasingly turning to pooling smaller cohorts and to using administrative datasets. While these approaches offer increased statistical power, which can overcome some challenges of individual cohort studies, they introduce other methodological challenges and the potential for bias. This symposium will review these methodological challenges and the approaches that can be used to mitigate the potential for important biases.

1) Overall analytic approaches (pooling individual data vs meta-analysis/meta-regression)

2) Missing or differential data on potential confounders

3) Suboptimal data on health outcomes

4) Non-random attrition in cohorts

5) Non-closed cohort concerns in administrative records

6) Precision of exposure assignment in large populations

7) Privacy issues

8) Differential time periods for cohort enrollment

9) Differences in quality of confounder measurement

Presenters will review standard and novel approaches to these methodological challenges. The symposium will include discussion of advantages and disadvantages of solutions.

The future of environmental epidemiology requires adjusting to new realities of research infrastructure. One key issue, understanding health effects at low-levels, requires large sample sizes to understand effects--which increasingly will require taking advantage of research platforms created for other purposes. Small effects, high risk of residual confounding, outcome classification, exposure measurement error. There are many threats to valid results--the same risks that plagued the history of Environmental Epidemiology are present in our future.